POSITIONS AND AREAS OF SUN SPOTS—Continued

Date	Eastern standard time	Heliographic			Area		Total area for each day	Observatory
		Diff. in longitude	Longitude	Latitude	Spot	Group		
	h. m.	°	°	°				
Mar. 29	11 15	+36.0	193.1	+19.0		436		U. S. Naval.
		+40.5	197.6	+8.0	36			
		+50.0	207.1	+10.0	24		1,562	
Mar. 30	12 14	−56.5	87.1	+15.0		97		
		−49.5	94.1	+9.0		73		
		−33.0	110.6	−9.0	97			
		+10.5	154.1	+11.0		242		
		+20.5	164.1	+9.5	194			
		+24.0	167.6	+7.0		291		
		+36.0	179.6	−15.0	48			
		+44.0	187.6	+17.0	48			
		+50.0	193.6	+20.5	121			
		+54.0	197.6	+19.0		242	1,453	
Mar. 31	11 15	−71.0	59.9	+23.0	145			Do.
		−43.0	87.9	+16.0		170		
		−36.5	94.4	+9.0		97		
		−21.0	109.9	−9.0		97		
		+5.0	135.9	+9.5		145		
		+23.0	153.9	+10.5		170		
		+33.0	163.9	+9.0	242			
		+38.0	168.9	+6.5		242		
		+49.0	179.9	−15.0	48			
		+63.0	193.9	+19.0		242		
		+69.0	199.9	+17.0	194		1,792	

Mean daily area for 28 days, 1,152.

PROVISIONAL SUN-SPOT RELATIVE NUMBERS FOR MARCH 1937

[Dependent alone on observations at Zurich and its station at Arosa]

[Through the courtesy of Prof. W. Brunner, Eidgen. Sternwarte, Zurich, Switzerland]

March 1937	Relative numbers	March 1937	Relative numbers	March 1937	Relative numbers
1	*Wac* 154	11	98	21	*Eac* 62
2	*b* 154	12	59	22	*Mc* 74
3	*Ec* 109	13	*a* 41	23	*d* 107
4	*Ecd* 65	14	21	24	*d* ---
5	76	15	20	25	87
6	71	16	*Ec* 23	26	*a* 80
7	*Wc* 105	17	22	27	*Mac* 118
8	*abd* 115	18	*Eac* 37	28	131
9	107	19	33	29	*a* 117
10	99	20	*d* ---	30	*a* 135
				31	*a* 145

Mean, 29 days=85.0.

a=Passage of an average-sized group through the central meridian.
b=Passage of a large group or spot through the central meridian.
c=New formation of a group developing into a middle-sized or large center of activity: E, on the eastern part of the sun's disk; W, on the western part; M, on the central circle zone.
d=Entrance of a large or average-sized center of activity on the east limb.

AEROLOGICAL OBSERVATIONS

[Aerological Division, D. M. LITTLE, in charge]

By L. P. HARRISON

Mean free-air data based on airplane weather observations during the month of March 1937 are given in tables 1 to 3. A description of the methods by which the various monthly means and normals therein are computed may be found in this section of the MONTHLY WEATHER REVIEW for January 1937. The "normals" of temperature, pressure, and relative humidity at the 1,500 and 2,500 meter levels for the Navy stations were obtained in a manner slightly different from the usual method. Prior to the year 1934, the data in the columns for 1,500 and 2,500 meters were not computed. It has been found expedient to obtain these data by linear interpolation for the purpose of the present summary.

It will be noted that many of the "normals" are based on only 3 years of observations. Conclusions based on departures from such short-period "normals" must be used with caution.

The mean surface temperatures for March (see chart I) were below normal over the country except in the Pacific coastal States, and Nevada, southern Utah, western Colorado, as well as Idaho, Montana, and North Dakota, where they were generally above normal. The largest negative departures at the surface were largely concentrated in the south-central part of the country, with values ranging from about −1.5° C. to −3.4° C. In addition, a secondary region of rather pronounced negative departures at the surface occurred in a strip nearly 150 miles wide extending from the vicinity of western Tennessee northeastward to about Burlington, Vt., with a lower extreme departure of nearly −3.0° C. The largest positive departures were principally confined to the northwestern border states with values ranging from +0.5° C. to +2.5° C. Elsewhere the departures were generally within the range ±1.5° C.

The mean free-air temperatures for the month up to 5 km above sea level (table 1) were generally below normal over the country except the extreme northwestern section and the Florida Peninsula and vicinity, where they were above normal. In harmony with the conditions at the surface, the most pronounced negative departures from normal were principally confined to an elliptical area extending (lengthwise) from the south-central to the northeastern portion of the country, with the major axis roughly thrice the minor axis. The departures in this area ranged approximately from −1.5° C. to −5.5° C. (Oklahoma City at 1 km), with departures slightly more pronounced over the northeastern than over the northwestern sector above 2 km. In the extreme southwest, significantly subnormal free-air temperatures also occurred as exemplified by departures from −0.6° C. to −2.9° C. (at 2 km) over San Diego, Calif. The most pronounced positive departures occurred over the general area comprising the Northwestern States from Washington to Montana, with values ranging as high as +4.2° C. (Spokane at 5 km). Elsewhere over the country, the departures from normal temperature were not very marked.

The mean free-air relative humidities and specific humidities are given in table 2. The mean relative humidities were moderately above normal in the Southwest, with maximum departures occurring at San Diego where they ranged from +4 to +13 percent. Over the central part of the country the departures were also generally positive by moderate amounts below 2 km, while above that elevation they were only slightly in excess of normal. Over the northern third of the country only slight positive departures from normal relative humidity generally prevailed, with maxima occurring near Billings and Boston, particularly in the lower strata (+10 percent at surface, falling to +6 percent at 1 km, over the former station; and +5 to +9 percent from 1 to 3 km, over the latter). Over the southeast, slight to moderate negative departures generally prevailed, except near the surface along the Gulf coast where the opposite was true. The extreme departures in this area occurred in the vicinity of Murfreesboro, Tenn., where the deficiencies with respect to normal ranged between −2 percent and

—11 percent from 1.5 to 5 km. Over other areas the departures from normal were generally not appreciable in amount.

Table 3 shows the monthly mean free-air barometric pressures and equivalent potential temperatures. The lowest mean barometric pressures prevailed over the northeastern part of the country, with the minima located near Boston in the stratum up to 1.5 km, and between that place and Sault Ste. Marie, but nearer the latter, at higher elevations, so far as available observations indicate. The statistical center of lowest mean pressure was thus displaced farther eastward with respect to its positions during the preceding 2 months. A secondary center of low pressure of considerably lesser intensity than the foregoing was in evidence in the lower strata over the extreme northwestern corner of the country. The highest mean barometric pressures in the free air over the country up to 5 km had their loci in the coastal strip contiguous to the Gulf of Mexico, displaced, however, in the lowest km more toward the western Gulf. The mean free-air isobars over the central and southern portions of the Western Plateau were characterized by a northward displacement with respect to their positions along the western and eastern boundaries of this elevated region, thus indicating by their anticyclonic curl the presence of weak statistical center of high pressure over the southern portion.

The mean isobaric charts for March, in marked contrast to those for the preceding 2 months, thus showed marked cyclonic curvature over the northeast in the lower strata with conditions apparently favorable there for the transport of air from the northwest and north into the eastern half of the country. The anticyclonic curvature of isobars over the Western Plateau and Gulf regions with practically straight west-east isobars in the upper strata over the eastern portion of the country were favorable for the transport of air from the Pacific toward the Western Plateau principally from a southwesterly direction, subsequently recurving so as to come from westerly and northwesterly directions in its trajectory across the plateau and the lower terrain to the east.

On the assumption that differences between the mean monthly barometric pressures given for the various pairs of stations are closely representative of the mean pressure gradients between the respective pairs of stations during the month, the data indicate that the mean pressure gradients from San Antonio to Oakland at levels up to 5 km remained practically the same in March as they had been in February. However, the gradients from Oakland to Fargo decreased by 113 percent at 1 km from February to March, i. e., the gradient reversed; and at higher levels decreased from 80 percent at 1.5 km to 37 percent at 5 km. On the other hand, the gradients from Billings to Sault Ste. Marie increased approximately 60 to 70 percent between the 2 months, while from Omaha to Boston where the mean gradients were practically nil in February the gradients during March were nearly as large as those which existed between the two stations just previously referred to. The gradients from Miami to Sault Ste. Marie decreased 33 percent at 1 km diminishing to 9 percent at 5 km, between the respective months.

Table 4 shows the free-air resultant winds based on pilot-balloon observations made near 5 a. m. (75th meridian time) during March. The resultant winds along the West coast near Oakland, while not greatly different from normal in velocity, were oriented from 50° to 90° counterclockwise from normal, i. e. more from the west and southwest than northwest. Similar conditions prevailed near Medford, Oreg., at elevations from 3 to 4 km, but free-air resultant winds below that stratum were approximately normal. Over Seattle, and Spokane, the resultant winds were oriented from 40° to 90° counterclockwise from normal, hence more from the south than west as usual, with velocities in excess of normal by 1 to 4 m. p. s. in the case of the former station, but deficient with respect to normal by 0.5 to 6.1 m. p. s. in the latter case. Near San Diego practically normal resultant winds prevailed. The resultant winds in the free air over Salt Lake City were oriented with respect to normal by about one-half the amounts specified for Seattle, with slightly deficient velocities.

In general, the resultant wind directions over the balance of the country were practically normal, except in the lowest kilometer above sea level between the Mississippi River and the Appalachian Mountains, where in many cases the resultants were oriented from 45° to 90° clockwise from normal, hence more from NW. than SW. and W. The resultant velocities over the balance of the country were generally deficient with respect to normal by several meters per second, except over the northeast sector where they were in excess of normal from 1.5 to 5.8 m. p. s. Over Billings, Cheyenne, Oklahoma City, and Pensacola, deficiencies of about 3 to 5 m. p. s., in resultant velocities occurred from 2.5 to 4 km, while over Houston excesses of about 0.9 to 5.9 m. p. s. occurred in the same stratum.

Table 5 shows maximum free-air wind velocities and directions for various sections of the United States during March as determined by pilot balloon observations. The extreme maximum was 59.0 m. p. s. from the NW at 6,840 meters above sea level over Greensboro, N. C.

The mean monthly equivalent potential temperatures and specific humidities are shown in tables 2 and 3, respectively. The geographic distributions of these elements indicate general conformity with the air trajectories inferred from the mean isobaric charts for the month. The relatively high values over Salt Lake City with respect to surrounding stations in the stratum from about 2 to somewhat over 4 km are especially noteworthy as indicative of the mean anticyclonic curl of the air motion above the Western Plateau already mentioned above.

Considerable contrast existed during March in the weather over the western and the eastern halves of the country. The eastern half was frequently dominated by extensive anticyclones, formed by the spreading out over this area of relatively cold Pc or Npc air masses from central and western Canada, overlain by strata of Pp or Npp origin, or mixed with them. This situation to a great extent prevented the transport of warm, moist Ta air masses from the Gulf of Mexico up the eastern portion of the Mississippi Valley. These factors contributed greatly to the subnormal temperatures and deficient precipitation generally experienced in the area under consideration; the charts given in the Weekly Weather and Crop Bulletin for the week ending April 6, 1937, indicate that only 25 to 75 percent of normal precipitation was observed there.

On the other hand, the Pacific coastal region was visited by an abnormally large number of cyclones from the ocean to the west and north, principally in an occluded state. The Npp and occasionally Tp air masses in the troughs of these cyclones, on being forced to ascend the Pp wedges of air, gave rise to strong development of the distrubances with the production of an abundance of precipitation over a large part of the Western Plateau region, from 150 to 250 percent of normal, except over parts of Utah, Colorado, and New Mexico; in the latter area precipitation was about 50 to 100 percent of normal. The advance of the Npp and Tp air masses eastward led to their interaction with the

considerably colder Pc air masses in the vicinity of the eastern flanks of the plateau, thus leading to excessive precipitation, from 150 to 200 percent of normal, in that area. The anticylonic circulation along the southwestern peripheries of the HIGHS which frequently lay over the southeastern part of the country did allow some TA air to move northward and westward across Texas and adjoining territory, in this way contributing in a fairly important degree to the precipitation which occurred over the western Great Plains by furnishing fresh moisture supplies for the occluding cyclones advancing eastward from the Pacific Southwest.

A few active cyclones formed in the western Gulf of Mexico and moved counterclockwise around the peripheries of the cold air masses extending over the southeastern part of the country. These gave a superabundance of rainfall in Florida, and contributed to the precipitation which occurred along the eastern coastal region as they advanced northward. On reaching the vicinity of the Gulf of St. Lawrence and Labrador, a majority of them had an extraordinary development and in some cases moved somewhat westward toward Hudson Bay. The strong cyclonic circulation about these storms caused the transportation of relatively cold, dry PA air into the northeastern part of the country, especially at moderate elevations above the ground. This was an important factor underlying the very deficient precipitation near the western Great Lakes and adjoining regions.

TABLE 1.—*Mean free-air temperatures (t), °C. obtained by airplanes during March 1937. (Dep. represents departure from "normal" temperature)*

Stations	Altitude (meters) m. s. l.																		
	Surface			500		1,000		1,500		2,000		2,500		3,000		4,000		5,000	
	Number of obs.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.
Barksdale Field [1] (Shreveport), La. (52 m)	31	9.0	-----	8.3	-----	7.0	-----	6.4	-----	4.5	-----	2.3	-----	0.0	-----	−6.6	-----	-----	-----
Billings, Mont.[2] (1,089 m)	28	−1.7	+0.2	-----	-----	-----	-----	0.3	+0.8	−1.3	+1.3	−3.6	+2.2	−6.4	+2.7	−12.3	+3.2	−18.8	+3.4
Boston, Mass.[1] (5 m)	30	−1.9	−2.2	−3.4	−1.2	−5.9	−1.8	−7.6	−2.2	−8.8	−2.1	−10.5	−1.9	−12.4	−1.9	−17.3	−1.7	-----	-----
Cheyenne, Wyo.[2] (1,873 m)	29	−3.5	−0.8	-----	-----	-----	-----	-----	-----	−2.6	−0.6	−4.4	−1.3	−7.1	−1.3	−13.4	−1.1	−20.7	−1.3
Coco Solo, Canal Zone [3] (15 m)	29	25.0	-----	22.7	-----	20.6	-----	18.3	-----	16.4	-----	15.5	-----	13.7	-----	8.0	-----	2.8	-----
El Paso, Tex.[2] (1,194 m)	31	7.2	-----	-----	-----	-----	-----	9.3	-----	7.3	-----	4.7	-----	1.3	-----	−5.2	-----	−11.3	-----
Fargo, N. Dak.[2] (274 m)	31	−6.7	−1.0	−5.3	−0.5	−6.6	−1.2	−7.4	−1.0	−9.0	−1.0	−11.1	−1.1	−13.1	−0.6	−18.1	0.0	−24.7	+0.4
Kelly Field (San Antonio), Tex.[1] (206 m)	25	8.4	−3.5	10.1	−4.0	9.5	−3.8	8.8	−3.4	8.0	−2.6	5.6	−2.8	3.7	−2.0	−2.4	−1.4	−9.3	−1.1
Lakehurst, N. J.[2] (39 m)	24	−0.7	−3.4	−1.5	−4.4	−3.9	−5.0	−5.0	−4.7	−6.0	−4.0	−8.1	−3.8	−10.5	−3.7	−15.4	−2.7	−21.2	−1.5
Maxwell Field (Montgomery), Ala.[1] (52 m)	22	9.8	−1.4	9.8	−2.6	7.9	−2.7	6.8	−1.6	5.3	−1.2	3.5	−0.7	0.7	−0.9	−5.1	−0.3	−11.6	−0.4
Miami, Fla.[3] (4 m)	31	16.8	-----	18.0	-----	14.9	-----	12.6	-----	10.8	-----	8.7	-----	6.4	-----	1.1	-----	−4.2	-----
Mitchel Field (Hempstead, L. I.), N. Y.[1] (29 m)	28	−0.8	−3.0	−1.6	−4.3	−3.4	−4.5	−5.1	−4.4	−6.0	−3.9	−7.8	−3.5	−9.9	−3.2	−14.1	−2.1	-----	-----
Murfreesboro, Tenn.[2] (174 m)	31	4.3	−3.1	4.8	−3.9	2.5	−4.5	1.5	−3.9	−0.4	−3.5	−1.7	−2.8	−3.9	−2.3	−9.3	−1.6	−15.8	−1.7
Norfolk, Va.[1] (10 m)	21	4.2	−2.7	4.0	−2.6	1.2	−3.4	−0.4	−2.8	−2.2	−2.5	−4.6	−2.9	−7.0	−3.2	−12.5	−2.8	−17.1	−1.9
Oakland, Calif.[2] (2 m)	31	10.0	-----	9.6	-----	7.2	-----	4.5	-----	1.6	-----	−0.9	-----	−3.5	-----	−9.8	-----	−16.5	-----
Oklahoma City, Okla.[2] (391 m)	31	4.1	−4.1	4.8	−4.3	3.8	−5.5	3.0	−4.8	1.9	−3.8	0.1	−3.0	−2.1	−2.4	−8.7	−2.0	−15.3	−1.7
Omaha, Nebr.[2] (300 m)	31	−0.4	−0.2	0.2	−0.3	−0.5	−1.3	−2.6	−2.5	−4.4	−2.8	−5.8	−1.9	−7.8	−1.2	−13.3	−0.3	−19.6	+0.1
Pensacola, Fla.[3] (13 m)	27	10.0	−1.4	10.7	−0.3	9.7	+0.4	8.6	+1.0	6.9	+1.3	4.6	+1.2	2.1	+0.9	−3.4	+0.8	−8.4	+2.1
St. Thomas, Virgin Islands [3] (8 m)	31	23.0	-----	20.7	-----	17.8	-----	14.8	-----	12.2	-----	10.9	-----	9.8	-----	5.1	-----	−0.3	-----
Salt Lake City, Utah [2] (1,288 m)	31	1.7	-----	-----	-----	-----	-----	4.3	-----	2.5	-----	−0.5	-----	−3.6	-----	−10.0	-----	−16.0	-----
San Diego, Calif.[3] (10 m)	31	10.6	−3.3	11.4	−1.5	9.8	−2.3	7.3	−2.7	4.7	−2.9	2.2	−2.6	−0.5	−2.4	−5.9	−1.1	−11.8	−0.6
Sault Ste. Marie, Mich.[2] (221 m)	31	−7.6	-----	−7.6	-----	−9.3	-----	−11.4	-----	−12.5	-----	−13.6	-----	−15.7	-----	−21.3	-----	−27.5	-----
Scott Field (Belleville), Ill.[1] (135 m)	19	0.0	−3.9	2.8	−3.3	0.9	−4.6	−0.5	−3.4	−2.2	−4.1	−4.0	−3.4	−6.1	−3.0	−10.9	−2.1	−17.6	−2.5
Seattle, Wash.[2] (10 m)	12	9.8	-----	7.7	-----	5.4	-----	2.0	-----	−1.2	-----	−4.5	-----	−7.7	-----	−14.3	-----	-----	-----
Selfridge Field (Mount Clemens), Mich.[1] (177 m)	28	−3.4	-----	−3.7	-----	−6.1	-----	−7.7	-----	−9.1	-----	−11.0	-----	−13.5	-----	−18.2	-----	−23.4	-----
Spokane, Wash.[2] (596 m)	31	1.9	+0.4	-----	-----	5.0	+2.6	3.1	+2.8	0.1	+3.1	−3.0	+3.1	−6.3	+3.2	−12.4	+3.7	−18.6	+4.2
Washington, D. C.[2] (13 m)	27	2.6	−1.2	2.1	−1.2	−0.3	−1.8	−2.2	−1.7	−3.6	−1.3	−5.5	−1.3	−8.0	−1.7	−13.2	−1.3	−19.4	−1.4
Wright Field (Dayton), Ohio [1] (244 m)	28	−1.4	−4.0	−0.7	−3.8	−1.8	−4.6	−3.7	−4.7	−5.3	−4.5	−7.2	−4.3	−9.4	−4.1	−14.2	−3.3	−20.4	−2.8

[1] Army.
[2] Weather Bureau.
[3] Navy.

Observations taken about 4 a. m., 75th meridian time, except by Navy stations along the Pacific coast and Hawaii where they are taken at dawn.

NOTE.—The departures are based on normals covering the following total number of observations made during the same month in previous years, including the current month (years of record are given in parentheses following the number of observations): Billings, 87 (3); Boston, 100 (4); Cheyenne, 88 (3); Fargo, 91 (3); Kelly Field, 84 (3); Lakehurst, 68 (3); Maxwell Field, 73 (3); Mitchel Field, 79 (3); Murfreesboro, 93 (3); Norfolk, 154 (8); Oklahoma City, 87 (3); Omaha, 185 (6); Pensacola, 153 (7); San Diego, 213 (9); Scott Field, (75) 3; Spokane, 92 (3); Washington, 154 (8); Wright Field, 84 (3).

TABLE 2.—*Mean free-air relative humidities (R. H.), in percent, and specific humidities (q), in grams/kilogram, obtained by airplanes during March 1937 (Dep. represents departure from "normal" relative humidity)*

Station	Altitude (meters) m. s. l.																											
	Surface				500			1,000			1,500			2,000			2,500			3,000			4,000			5,000		
	Number of observations	q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.	
			Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.
Barksdale Field, La	31	5.6	78	----	4.7	65	----	4.3	61	----	3.8	53	----	3.3	50	----	2.7	44	----	2.2	41	----	1.4	35	----			
Billings, Mont	28	3.0	79	+10	----	----	----	----	----	----	3.2	68	+8	2.9	64	+6	2.5	61	+2	2.1	61	0	1.3	56	−3	0.8	51	−3
Boston, Mass	30	2.3	70	+2	2.3	70	+2	2.0	72	+6	1.8	72	+9	1.7	66	+6	1.5	64	+5	1.2	61	+5	0.9	55	+3	----	----	----
Cheyenne, Wyo	29	2.7	72	+9	----	----	----	----	----	----	----	----	----	2.8	69	+7	2.4	65	+7	2.1	63	+7	1.3	58	+3	0.7	56	+4
Coco Solo, Canal Zone	29	17.5	86	----	17.2	92	----	15.1	87	----	12.9	81	----	11.7	78	----	7.8	52	----	5.0	35	----	3.8	35	----	2.6	30	----
El Paso, Tex	31	3.6	49	----	----	----	----	----	----	----	4.0	45	----	3.7	46	----	3.3	47	----	3.0	49	----	1.8	44	----	1.0	34	----
Fargo, N. Dak	31	2.0	83	0	2.0	75	−2	1.7	68	0	1.7	64	+1	1.5	61	+1	1.3	61	+2	1.2	60	+4	0.9	58	+5	0.6	58	+6
Kelly Field, Tex	25	5.6	80	−2	5.7	70	−3	5.1	62	−3	4.6	55	−3	4.4	52	−2	4.0	52	+4	3.3	47	+3	2.4	46	+4	1.7	48	+7
Lakehurst, N. J	24	2.6	70	−5	2.2	59	−4	2.0	61	+1	1.8	59	+1	1.8	55	+2	1.7	57	+4	1.6	58	+6	0.8	49	+2	0.6	55	+9
Maxwell Field, Ala	22	5.4	72	−3	4.7	59	−1	3.7	50	−2	3.5	47	−1	2.9	41	0	2.3	37	+2	2.0	36	+3	1.2	32	+2	0.8	28	−2
Miami, Fla	31	10.8	92	----	10.2	75	----	8.7	74	----	7.0	65	----	5.6	56	----	4.6	50	----	3.9	47	----	3.1	48	----	2.4	46	----
Mitchel Field, N. Y	28	2.4	68	−9	2.4	67	−2	2.2	65	−1	1.9	63	0	1.8	56	−1	1.7	55	−1	1.5	54	−1	1.3	59	+4	----	----	----
Murfreesboro, Tenn	31	4.2	81	0	3.9	70	0	3.4	67	0	3.0	59	−2	2.1	47	−8	2.0	46	−5	1.9	45	−5	1.1	37	−7	0.6	31	−11
Norfolk, Va	21	3.4	68	−1	2.9	54	−6	2.6	56	−2	2.2	51	−5	1.9	48	−5	1.6	46	−3	1.4	43	−2	0.8	37	−6	0.6	37	−6
Oakland, Calif	31	6.7	88	----	6.0	76	----	5.0	70	----	4.0	65	----	3.3	62	----	2.8	58	----	2.3	56	----	1.6	53	----	0.9	48	----
Oklahoma City, Okla	31	4.1	77	+8	4.1	73	+7	3.8	68	+11	3.3	60	+9	2.8	52	+6	2.2	44	+3	2.0	42	+2	1.4	43	+2	0.9	44	+3
Omaha, Nebr	31	3.4	87	+9	3.3	80	+7	2.9	71	+9	2.7	71	+14	2.2	61	+9	1.8	54	+3	1.6	54	+2	1.2	54	+2	0.8	55	+3
Pensacola, Fla	27	6.6	86	+7	6.2	74	+5	5.4	64	+3	4.4	53	−2	3.5	44	−6	3.1	45	−3	2.6	41	−4	1.9	39	−3	1.3	36	−5
St. Thomas, Virgin Islands	31	14.8	85	----	14.0	87	----	12.1	86	----	9.9	80	----	7.7	69	----	5.4	48	----	3.4	31	----	1.8	19	----	1.0	15	----
Salt Lake City, Utah	31	3.9	78	----	----	----	----	----	----	----	4.1	67	----	3.7	64	----	3.2	65	----	2.8	68	----	2.1	71	----	1.2	61	----
San Diego, Calif	31	6.8	85	+11	6.6	74	+4	5.4	65	+9	4.3	58	+11	3.5	52	+13	2.7	45	+12	2.2	41	+11	1.3	36	+9	0.9	34	+7
Sault Ste. Marie, Mich	31	1.7	77	----	1.8	74	----	1.5	70	----	1.3	68	----	1.2	63	----	1.0	58	----	0.9	57	----	0.8	59	----	0.4	54	----
Scott Field, Ill	19	3.0	81	+2	3.1	66	+1	2.7	59	+3	2.2	51	+1	1.9	47	0	1.7	43	−1	1.6	43	−1	1.1	42	+1	0.8	43	−1
Seattle, Wash	12	5.7	77	----	4.7	71	----	4.1	68	----	3.4	66	----	2.9	67	----	2.5	68	----	2.1	67	----	1.3	64	----	----	----	----
Selfridge Field, Mich	28	2.3	76	----	2.2	72	----	1.9	69	----	1.7	63	----	1.4	58	----	1.3	57	----	1.1	55	----	0.7	50	----	0.5	49	----
Spokane, Wash	31	3.7	79	+3	----	----	----	4.0	65	−2	3.6	63	−1	3.3	65	+1	2.7	65	+2	2.3	65	+1	1.4	60	−1	0.9	56	−3
Washington, D. C	27	3.4	73	+3	2.8	62	−1	2.6	61	+1	2.4	61	+2	2.1	58	+1	1.9	55	+2	1.6	53	+2	1.1	50	+1	0.7	43	−2
Wright Field, Ohio	28	2.9	83	+4	2.9	76	+2	2.7	72	+5	2.3	66	+4	1.9	57	0.0	1.5	52	−1	1.3	50	0.0	1.0	48	+1	0.7	49	+1

TABLE 3.—*Mean free-air barometric pressures (P), in mb, and equivalent potential temperatures (θ_e), in °A. obtained by airplanes during March 1937*

Stations	Altitude (meters) m. s. l.																			
	Surface			500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
	Number of observations	P	θ_e	P	θ_e	P	θ_e	P	θ_e	P	θ_e	P	θ_e	P	θ_e	P	θ_e	P	θ_e	
Barksdale Field, La	31	1,013	297	960	298	904	301	850	304	800	306	751	307	706	309	622	310	----	----	
Billings, Mont	28	893	289	----	----	----	----	848	296	797	299	748	300	702	302	616	304	540	306	
Boston, Mass	30	1,011	277	950	280	892	331	837	285	785	288	736	291	689	294	604	299	----	----	
Cheyenne, Wyo	29	809	294	----	----	----	----	----	----	796	297	747	300	701	301	615	303	538	304	
Coco Solo, Canal Zone	29	1,009	350	952	352	899	349	848	346	800	346	753	339	710	334	630	334	558	336	
El Paso, Tex	31	881	301	----	----	----	----	848	308	799	310	752	312	706	311	624	313	549	314	
Fargo, N. Dak	31	988	273	961	276	902	280	846	284	793	287	744	290	696	292	610	297	532	300	
Kelly Field, Tex	25	995	297	963	302	906	305	853	308	803	312	755	314	711	315	628	317	554	318	
Lakehurst, N. J	24	1,010	279	953	281	895	284	838	287	788	291	739	294	694	297	608	300	534	304	
Maxwell Field, Ala	22	1,011	297	958	300	902	300	848	304	798	306	751	308	706	309	622	310	548	314	
Miami, Fla	31	1,016	318	959	324	905	321	853	320	804	319	756	320	712	320	630	323	556	326	
Mitchel Field, N. Y	28	1,011	278	953	282	895	285	840	287	788	291	739	294	693	298	609	303	----	----	
Murfreesboro, Tenn	31	997	289	958	292	901	293	847	297	796	298	748	302	702	304	618	306	542	309	
Norfolk, Va	21	1,015	286	956	289	898	290	844	293	793	296	744	297	699	299	613	302	539	308	
Oakland, Calif	31	1,016	300	957	303	901	303	848	303	797	304	749	304	704	305	619	308	544	309	
Oklahoma City, Okla	31	972	291	960	293	902	296	848	299	797	302	749	304	704	306	620	308	544	310	
Omaha, Nebr	31	984	283	959	286	901	289	846	292	794	294	745	296	699	299	613	303	538	306	
Pensacola, Fla	27	1,020	300	962	304	906	306	853	308	803	309	755	311	709	312	626	315	552	318	
St. Thomas, Virgin Islands	31	1,015	337	960	337	905	334	853	330	804	327	757	324	713	323	632	324	559	326	
Salt Lake City, Utah	31	870	297	----	----	----	----	848	302	798	305	750	306	704	307	620	308	545	310	
San Diego, Calif	31	1,015	301	957	307	901	307	848	307	798	307	750	308	705	309	622	311	547	314	
Sault Ste. Marie, Mich	31	990	271	955	274	895	277	838	279	785	282	735	287	688	289	602	294	525	297	
Scott Field, Ill	19	1,005	281	962	287	903	290	849	292	797	295	748	298	702	300	616	305	540	308	
Seattle, Wash	12	1,014	297	956	297	899	299	844	298	793	299	745	300	699	301	613	302	----	----	
Selfridge Field, Mich	28	996	276	956	279	898	281	843	284	791	287	741	290	694	292	608	296	532	301	
Spokane, Wash	31	945	290	----	----	900	298	846	300	795	302	746	303	701	303	615	304	540	307	
Washington, D. C	27	1,017	284	955	287	898	289	843	291	792	294	743	297	697	299	611	303	536	306	
Wright Field, Ohio	28	989	280	957	284	899	287	845	289	793	292	744	294	698	297	612	301	537	305	

TABLE 4.—*Free-air resultant winds (meters per second) based on pilot-balloon observations made near 5 a. m. (E. S. T.) during March 1937*

[Wind from N=360°, E=90°, etc.]

Altitude (meters) m. s. l.	Albuquerque, N. Mex. (1,554 m)		Atlanta, Ga. (309 m)		Billings, Mont. (1,088 m)		Boston, Mass. (15 m)		Cheyenne, Wyo. (1,873 m)		Chicago, Ill. (192 m)		Cincinnati, Ohio (153 m)		Detroit, Mich. 204 m)		Fargo, N. Dak. (274 m)		Houston, Tex. (21 m)		Key West, Fla. (11 m)		Medford, Oreg. (410 m)		[E]Murfreesboro, Tenn. (180 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	345	0.1	312	3.0	328	1.6	304	3.1	286	4.9	321	2.0	327	1.2	294	2.5	5	1.0	42	2.2	66	2.2	341	0.4	324	1.1
500	-----	-----	309	4.8	-----	-----	304	9.4	-----	-----	323	4.4	325	2.4	311	6.1	308	1.5	100	3.8	93	4.0	312	0.4	341	2.8
1,000	-----	-----	308	5.8	-----	-----	303	9.6	-----	-----	332	5.1	307	4.8	310	7.7	325	3.2	145	1.2	138	2.7	178	1.8	299	4.5
1,500	-----	-----	287	6.6	263	2.6	299	10.7	-----	-----	308	8.2	299	6.5	301	9.0	304	4.6	255	2.7	211	1.4	193	3.9	272	5.5
2,000	307	1.8	282	7.5	276	2.6	297	12.1	290	6.7	303	10.5	297	8.0	305	11.2	308	7.7	275	4.5	244	2.5	209	6.1	295	6.8
2,500	291	3.7	296	8.8	303	4.0	294	14.0	298	8.5	295	12.8	311	7.4	305	12.6	308	9.9	269	6.5	260	3.4	226	5.6	302	8.5
3,000	288	5.9	284	10.5	295	5.9	292	16.3	311	7.6	-----	-----	-----	-----	293	11.2	300	10.1	275	9.0	275	4.4	210	4.3	306	9.7
4,000	269	7.8	-----	-----	291	7.0	-----	-----	299	7.1	-----	-----	-----	-----	-----	-----	-----	-----	280	12.7	282	6.0	239	9.4	-----	-----
5,000	261	8.7	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Altitude (meters) m. s. l.	Newark, N. J. (14 m)		Oakland, Calif. (8 m)		Oklahoma City, Okla. (402 m)		Omaha, Nebr. (306 m)		Pearl Harbor, Territory of Hawaii [1] (68m)		Pensacola, Fla.[1] (24 m)		St. Louis, Mo. (170 m)		Salt Lake City, Utah (1,294 m)		San Diego, Calif. (15 m)		Sault Ste. Marie, Mich. (198 m)		Seattle, Wash. (14 m)		Spokane, Wash. (603 m)		Washington, D. C. (10 m)	
	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity	Direction	Velocity
	°		°		°		°		°		°		°		°		°		°		°		°		°	
Surface	284	3.3	231	0.6	27	0.9	30	1.1	36	3.2	11	3.9	308	1.3	151	2.5	38	0.5	340	1.4	128	0.6	88	1.9	310	2.1
500	299	6.4	253	1.8	172	1.8	321	1.2	69	5.1	38	2.7	307	2.8	-----	-----	271	2.2	356	3.7	153	2.6	-----	-----	301	7.8
1,000	309	8.8	274	1.3	238	4.1	292	2.8	92	4.7	293	2.1	305	3.5	-----	-----	274	2.9	338	5.6	162	4.8	115	3.0	304	9.4
1,500	301	11.0	252	2.0	259	2.9	301	4.2	112	3.1	271	6.1	297	5.4	158	3.6	275	3.1	325	6.3	169	4.6	178	2.4	302	11.0
2,000	288	11.7	250	2.0	298	4.7	306	7.1	168	2.7	284	6.2	288	6.4	182	3.7	295	4.0	318	9.1	163	4.2	199	2.8	288	11.6
2,500	296	17.6	222	3.9	293	4.7	305	8.5	216	3.0	295	4.9	293	7.5	221	3.0	303	5.4	314	10.6	172	6.2	213	3.7	279	12.2
3,000	-----	-----	224	5.0	285	4.3	312	11.6	223	4.4	290	7.2	289	7.9	249	3.5	289	6.1	296	8.9	186	7.1	233	4.4	-----	-----
4,000	-----	-----	-----	-----	299	8.0	316	10.5	320	2.4	285	8.7	289	7.9	263	5.0	290	6.9	271	4.4	-----	-----	238	2.8	-----	-----
5,000	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	275	6.1	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

[1] Navy stations.

TABLE 5.—*Maximum free-air wind velocities (M. P. S.) for different sections of the United States based on pilot balloon observations during March 1937*

Section	Surface to 2,500 meters (m. s. l.)					Between 2,500 and 5,000 meters (m. s. l.)					Above 5,000 meters (m. s. l.)				
	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station	Maximum velocity	Direction	Altitude (m) M. S. L.	Date	Station
Northeast [1]	40.1	NW	2,500	7	Albany, N. Y.	49.2	NNW	3,600	7	Albany, N. Y.	27.4	W	5,760	31	Albany, N. Y.
East-Central [2]	32.8	NNW	1,540	28	Washington, D. C.	49.0	WNW	4,060	17	Washington, D. C.	59.0	NW	6,840	5	Greensboro, N. C.
Southeast [3]	27.1	WSW	2,440	8	Jacksonville, Fla.	42.6	W	4,960	28	Jacksonville, Fla.	42.6	W	5,050	28	Jacksonville, Fla.
North-Central [4]	30.0	NNW	2,470	8	St. Paul, Minn.	40.8	W	4,970	22	Detroit, Mich.	41.6	WNW	5,950	22	Fargo, N. Dak.
Central [5]	29.1	NW	2,380	8	Omaha, Nebr.	36.8	NW	3,820	9	Omaha, Nebr.	41.2	WNW	6,100	21	Indianapolis, Ind.
South-Central [6]	34.0	W	1,200	24	Oklahoma City, Okla.	32.0	W	4,360	6	Del Rio, Tex.	35.0	W	8,160	20	Dallas, Tex.
Northwest [7]	30.7	SE	1,650	21	Boise, Idaho	33.6	SW	4,010	23	Medford, Oreg.	38.0	WNW	10,990	7	Missoula, Mont.
West-Central [8]	31.3	NW	2,480	23	Cheyenne, Wyo.	38.2	SSW	4,090	22	Modena, Utah	56.4	WNW	7,870	18	Redding, Calif.
Southwest [9]	26.5	WSW	1,900	23	Winslow, Ariz.	37.0	NNE	4,800	3	Las Vegas, Nev.	51.4	WSW	6,080	25	Winslow, Ariz.

[1] Maine, Vermont, New Hampshire, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, and northern Ohio.
[2] Delaware, Maryland, Virginia, West Virginia, southern Ohio, Kentucky, eastern Tennessee, and North Carolina.
[3] South Carolina, Georgia, Florida, and Alabama.
[4] Michigan, Wisconsin, Minnesota, North Dakota, and South Dakota.
[5] Indiana, Illinois, Iowa, Nebraska, Kansas, and Missouri.
[6] Mississippi, Arkansas, Louisiana, Oklahoma, Texas (except El Paso), and western Tennessee.
[7] Montana, Idaho, Washington, and Oregon.
[8] Wyoming, Colorado, Utah, northern Nevada, and northern California.
[9] Southern California, southern Nevada, Arizona, New Mexico, and extreme west Texas.

LATE REPORT

TABLE 1.—*Mean free-air temperatures (t), °C obtained by airplanes during February, 1937. (Dep. represents departure from "normal" temperature)*

Stations	Number of observations	Altitude (meters) m. s. l.															
		Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000	
		t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.
Pearl Harbor, Territory of Hawaii [1] (6 m)	26	19.2	−1.3	18.2	−0.8	14.9	−0.4	11.9	−0.4	9.5	+0.8	7.5	−0.2	5.5	−0.5	0.6	+0.1	−5.2	+1.1

[1] Navy.

Observations taken at dawn.

NOTE.—The departures are based on normals covering the following total number of observations made during the same month in previous years, including the current month (years of record are given in parentheses following the number of observations): Pearl Harbor, 115 (5).

LATE REPORT

TABLE 2.—*Mean free-air relative humidities (R. H.), in percent, and specific humitidies (q), in grams/kilogram, obtained by airplanes during February 1937. (Dep. represents departure from "normal" relative humidity)*

Station	Altitude (meters) m. s. l.																													
	Number of observations	Surface			500			1,000			1,500			2,000			2,500			3,000			4,000			5,000				
		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.			
			Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.			
Pearl Harbor, Territory of Hawaii	26	11.8	86	+8	10.7	78	+3	9.6	82	+5	8.7	85	+12	7.3	79	+23	5.2	62	+18	4.2	53	+19	2.0	32	+12	1.2	29	+9		

LATE REPORT

TABLE 3.—*Mean free-air barometric pressures (P), in mb, and equivalent potential temperatures (Θ_E), in °A. obtained by airplanes during February 1937*

Station	Altitude (meters) m. s. l.																			
	Number of observations	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
		P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	
Pearl Harbor, Territory of Hawaii	26	1,016	324	959	325	904	324	852	324	802	322	755	320	710	320	628	319	553	322	

LATE REPORT

TABLE 1.—*Mean free-air temperatures (t), °C obtained by airplanes during January 1937. (Dep. represents departure from "normal" temperature.)*

Station	Altitude (meters) m. s. l.																			
	Number of observations	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
		t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	t	Dep.	
Pearl Harbor, Territory of Hawaii [1] (6 m)	31	19.3	−1.3	19.2	0.0	15.9	+0.5	13.1	+0.6	10.9	+0.3	8.7	+0.1	5.9	0.0	0.8	+0.1	−5.6	−0.1	

[1] Navy.

Observations taken at dawn.

NOTE.—The departures are based on normals covering the following total number of observations made during the same month in previous years, including the current month (years of record are given in parentheses following the number of observations): Pearl Harbor, 117 (4).

LATE REPORT

TABLE 2.—*Mean free-air relative humidities (R. H.), in percent, and specific humidities (q), in grams/kilogram, obtained by airplanes during January 1937. (Dep. represents departure from "normal" relative humidity)*

Station	Altitude (meters) m. s. l.																													
	Number of observations	Surface			500			1,000			1,500			2,000			2,500			3,000			4,000			5,000				
		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.		q	R. H.			
			Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.		Mean	Dep.			
Pearl Harbor, Territory of Hawaii	31	12.0	87	+8	811.2	77	+2	10.1	80	+2	8.4	76	+3	6.4	64	+5	5.0	54	+6	3.9	49	+8	2.3	35	+6	1.8	37	+10		

LATE REPORT

TABLE 3.—*Mean free-air barometric pressures (P), in mb, and equivalent potential temperatures (Θ_E), in °A. obtained by airplanes during January 1937*

Station	Altitude (meters) m. s. l.																			
	Number of observations	Surface		500		1,000		1,500		2,000		2,500		3,000		4,000		5,000		
		P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	P	Θ_E	
Pearl Harbor, Territory of Hawaii	31	1,013	324	957	328	902	327	851	324	802	322	755	320	710	320	628	321	553	323	